

Mark scheme - Hormonal Communication

Question	Answer/Indicative content	Marks	Guidance
1	A	1	
	Total	1	
2	D	1	
	Total	1	
3	B	1	
	Total	1	
4	D	1	
	Total	1	
5	C ✓	1	<p><u>Examiner's Comments</u></p> <p>This question provided significant challenge to candidates. Only statements 2 and 3 were correct thereby giving option C as the correct response.</p>
	Total	1	
6	B ✓	1 (AO2.5)	<p><u>Examiner's Comments</u></p> <p>This question provided a significant challenge for some candidates. Candidates needed to process information in the three statements about the movement of ions in response to aldosterone secretion. Only statements 1 and 2 were correct and higher ability candidates often deduced that option B was the correct response. Option C was the most common incorrect response.</p>
	Total	1	
7	<p>* Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.</p>	9	<p>Indicative scientific points may include...</p> <ul style="list-style-type: none"> • Independent variable – concentration of GH injected • Dependent variable – rate of growth

	<p>Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.</p> <p>Once the level is located, award the higher, middle or lower mark.</p> <p>The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.</p> <p>The middle mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.</p> <p>The lower mark should be awarded where the level descriptor has been evidenced but the communication statement (in italics) has not been met.</p> <p>In summary:</p> <ul style="list-style-type: none"> • The science content determines the level. • The communication statement determines the mark within a level. <p>Level 3 (7–9 marks)</p> <p>A full and detailed method is provided which would allow valid comparisons and data to be collected. There is a detailed explanation of the variables to be changed and measured, and how this could realistically be attempted in the scenario provided, along with detailed information about which variables need to be controlled. There is an appreciation of ethical concerns involved OR an appreciation of the sample size required to obtain repeatable data and to rule out anomalies.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The method is detailed and clearly argued.</i></p>	<ul style="list-style-type: none"> • Control variables – animal species, foodstuff, (named) conditions • Trial populations over several months • Control group to ensure validity of conclusions • Method for assessing growth – e.g. % mass change or growth rate to allow comparability • Different species of chickens should be investigated • Ensure food is consistent across all trial groups • Sample size needs to be large enough to reduce effect of anomalies • Ethical concerns – chickens should be reared in humane conditions • Consideration of potential negative effects on chickens, e.g. larger muscle mass, so may be unable to move as easily
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		<p>Level 2 (4–6 marks)</p> <p>A detailed method is provided which would allow valid comparisons and data to be collected. There is an explanation of the variables to be changed and measured, and how this could be attempted in the scenario provided, along with information about which variables need to be controlled. There is mention of the sample size required to obtain representative data.</p> <p><i>There is a line of reasoning presented with some structure. The method has some detail.</i></p> <p>Level 1 (1–3 marks)</p> <p>A limited method is provided which may allow valid comparisons and data to be collected. There is some explanation of the variables to be changed and measured, and how this could be attempted, along with limited information about which variables need to be controlled. Possible consideration of the sample size required for representative data is included.</p> <p><i>There is a logical structure to the answer. The explanation, though basic, is clear.</i></p> <p>0 marks</p> <p>No response or no response worthy of credit.</p>		
		Total	2	
8		(binds to) receptor in, cell surface / plasma, membrane (1) glycoprotein (1)	2	
		Total	2	
9	a	<p>any 4 from:</p> <p>no production of hCG, until 4 weeks / AW (1)</p> <p>rapid increase / high gradient, until 8 weeks (1)</p> <p><i>idea that</i> rate of decline, is less than increase after 8 weeks (1)</p> <p>levels peak at 8 weeks (1)</p> <p>levels fluctuate / not constant, after 19 weeks (1)</p> <p><i>idea that</i> levels remain similar after 19 weeks (1)</p>	4	<p>All points with dates underlined must have exact wording to achieve mark</p> <p>ALLOW hCG production starts at 4 weeks / is undetectable until 4 weeks</p> <p>ALLOW 'fluctuation' / AW</p> <p>DO NOT ALLOW 'plateau'</p>

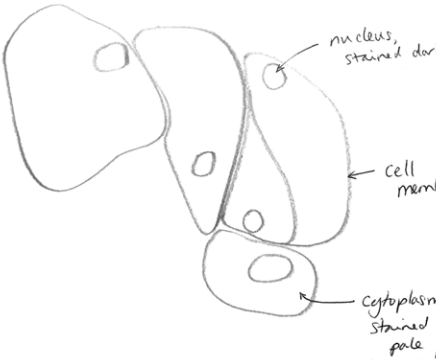
		use of comparative figures to illustrate any point with units (1)		
	b	i (hCG is a) peptide hormone / hCG is not a lipid-based hormone (1) (hCG) binds to cell surface receptor (1) <i>idea that</i> cell signalling is involved in action of hCG (1) (hCG) uses cAMP / second messenger, to bring about response in cell (1)	3	
		ii DNA / deoxyribonucleic acid	1	ALLOW transcription(al) factor / repressor protein DO NOT ALLOW RNA / histone / DNA polymerase
	c	<i>idea that</i> (hydatidiform mole) cells produce more hCG than normal (1) (due to) expression / up regulation, of genes (1) synthesising more, hCG / protein(s) (1) <i>idea that</i> other tissues could be stimulated to produce more hCG than normal (1)	3	Cannot be inferred from other mark points ALLOW stimulates, mitosis in / proliferation of, cells that secrete hCG ALLOW <i>idea that</i> hydatidiform mole inhibits / competes with another molecule that would otherwise regulate the production of hCG
		Total	11	
1 0		i	2 (AO1.1)	1 mark per correct column ALLOW adrenaline for noradrenaline in column one ALLOW for functions any two of the following: <ul style="list-style-type: none"> • increases heart rate • increases blood glucose concentration • increases blood flow to muscles • increases glycogenolysis • causes pupils to dilate • decreases blood flow to gut • increases blood pressure • dilation of bronchioles • increases air flow to alveoli • increases breathing rate Examiner's Comments

Hormone produced	Functions of hormone
adrenaline	TWO functions from list in guidance
noradrenaline	increases heart rate, increases blood pressure, widens pupils.
androgens	regulation of sexual characteristics and cell growth
glucocorticoids / cortisol / corticosterone	regulation of metabolism

✓

✓

					Generally, candidates performed better on the second column and were able to correctly include functions of adrenaline as increasing heart rate, blood pressure or breathing rate. It was a common error that candidates often did not realise that the question was in the context of the adrenal gland. Therefore, although the majority recognised noradrenaline, many gave hormones such as insulin or thyroxine as a regulator of metabolism in the first column. Mineralocorticoids was another common incorrect answer.									
		ii	B AND (adrenal) medulla ✓	1 (AO1. 1)	BOTH required for one mark <u>Examiner's Comments</u> There were many correct responses for this part of the question. Some candidates gave either the letter or the name of the region and, although correct, no credit could be given as both were needed for one mark.									
		Total		3										
1 1	a	One mark per correct row <table border="1" data-bbox="320 1218 836 1552"> <thead> <tr> <th>Region of adrenal gland</th> <th>Hormone produced</th> <th>Role of hormone in body</th> </tr> </thead> <tbody> <tr> <td>cortex</td> <td></td> <td>Na⁺ / K⁺ / ion , reabsorption in kidneys / concentration in blood OR water reabsorption OR control of blood pressure</td> </tr> <tr> <td></td> <td>adrenaline</td> <td></td> </tr> </tbody> </table>		Region of adrenal gland	Hormone produced	Role of hormone in body	cortex		Na ⁺ / K ⁺ / ion , reabsorption in kidneys / concentration in blood OR water reabsorption OR control of blood pressure		adrenaline		2	ALLOW epinephrine / noradrenaline / norepinephrine
Region of adrenal gland	Hormone produced	Role of hormone in body												
cortex		Na ⁺ / K ⁺ / ion , reabsorption in kidneys / concentration in blood OR water reabsorption OR control of blood pressure												
	adrenaline													
	b	i	A B	2										
		ii	five cells drawn adjacent to each other AND clear continuous lines (1) correct proportions (1) uses ≥50% of area provided (1) <i>annotations:</i> label lines drawn with a ruler to correct feature	5	DO NOT ALLOW cells separated by gaps DO NOT ALLOW more than five cells DO NOT ALLOW ragged lines / any shading ALLOW if it is clear which cells the candidate has attempted to draw IGNORE any annotations not mentioned									



		<p>(1) cell membrane AND nucleus AND cytoplasm labelled (1) comparative colour of any of above mentioned (1)</p>		<p>here DO NOT ALLOW arrow heads</p> <p>ALLOW implied comparison from different colours</p> <p>NOTE:</p>  <p>= 3 marks (MP2, 3 and 6)</p>
		Total	7	
1 2		<p>K = islet of Langerhans ✓ L = blood vessel ✓</p>	<p>2 (AO2. 1)</p>	ALLOW arteriole / venule
		Total	2	
1 3		<p>W liver / hepatic ✓ X pancreas / pancreatic ✓ Y skeletal / striated , <u>muscle</u> ✓</p>	<p>3</p>	<p>IGNORE cells</p> <p>ALLOW Islet of Langerhans / acini</p> <p>Examiner's Comments</p> <p>Generally this question was well-answered and it was clear that many candidates had seen images of tissues similar to those shown in Fig. 23.1. Credit could not be given for 'skeletal' or 'muscle' (tissue) for Y which were commonly seen incorrect responses. 'Skeletal' could also apply to other types of tissue found in the skeleton e.g. bone, and 'muscle' could also apply to other types of muscle tissue e.g. smooth muscle.</p>
		Total	3	

1 4	i	beta / β (cells) ✓	1 (AO1.1)	
	ii	glucose (concentration) causes release of insulin / AW ✓ change in insulin secretion is high enough to be measured / AW ✓	2 (AO3.3 AO2.3)	IGNORE synthesis or production of insulin ALLOW amount of insulin (secreted by the cells) was high enough to measure
	ii i	(unpaired) t-test ✓ because they are comparing <u>means</u> ✓	2 (AO3.3 AO2.3)	DO NOT ALLOW paired t-test IGNORE reference to tailed IGNORE standard deviation IGNORE reference to null hypothesis
	i v	<u>probability</u> is, less than / <, 0.1% / 0.001 ✓ (so) results / differences between means, were due to <u>chance</u> ✓	2 (AO2.4 AO3.1)	ALLOW for 2 marks e.g. there is less than 1 in 1000 <u>probability</u> that the results are due to <u>chance</u> OR ora e.g. there is greater than 99.9% <u>probability</u> that results are not due to <u>chance</u>
	v	Ca ²⁺ / calcium ions, do not enter (cells) ✓ less / no, exocytosis ✓	2 (AO2.4)	ALLOW for 1 max description of what happens without the inhibitor ALLOW less / no, movement of vesicles towards membrane ALLOW less / no, vesicles fuse with membrane DO NOT ALLOW vesicles not secreted
		Total	9	
1 5		B	1 (AO1.2)	
		Total	1	
1 6	a i	(pancreatic) beta / B, cells ✓	1	
	ii	<i>type I because:</i> (type I) results from a shortage of beta cells (in the pancreas) ✓ <i>idea that</i> stem cell therapy might increase insulin production ✓	2 max	

		<i>idea that</i> type II diabetes usually results from insulin resistance (rather than a lack of insulin)✓		
	b	the type of diabetes (being treated) ✓ age (of patients) ✓ gender (of patients)✓ <i>idea of</i> how the improvement was measured ✓ <i>idea of</i> when the improvement was measured ✓		ACCEPT extent of improvement / AW
	c	i 0.93 ✓✓✓	3	ACCEPT calculator value of 0.928977933 and any correct rounding Apply ECF throughout Max 2 if answer is incorrect AWARD 1 mark for calculating the mean (9.26) AWARD 1 mark for 5 correct subtractions (0.56, 0.56, 0.26, 0.26, 1.64) AWARD 1 mark for summation ($\Sigma = 3.452$) AWARD 1 mark for dividing by 4 ($/n-1$)
		ii <i>standard deviation is:</i> less affected by the, 10.9 value / outlier / anomaly ✓ <i>idea of</i> takes into account every value in the data ✓	2	ora throughout
		ii <i>idea of</i> blood glucose measured using the same method ✓ blood glucose measured the same number of times of day / after eating ✓ i <i>idea of</i> taking into account the patients' medical history / age / sex ✓ <i>idea of</i> correct use of statistical test ✓	2 max	ALLOW blood glucose measured the same number of times ACCEPT measurement of baseline blood glucose levels (prior to therapy) e.g. unpaired t-test

Total			13
1 7	i	<p>(Type) 2 / II / two ✓</p> <p><i>explanation:</i> insulin is (still) produced ✓ beta / β , cells still working ✓</p> <p><i>idea that</i> (liver) cells no longer respond to insulin ✓ fewer / damaged , (insulin) receptors ✓</p> <p>if it was Type I then the woman would not produce (normal levels of) insulin ✓</p>	<p>2 max</p> <p>ALLOW it is diabetes mellitus not diabetes insipidus ALLOW late onset</p> <p>1 mark max for explanation</p> <p>DO NOT ALLOW B / b , cells</p> <p>ALLOW (develop) insulin resistance</p> <p>ALLOW (insulin) receptors not working</p>
	ii	<p>low , carbohydrate / sugar , diet ✓</p> <p>exercise ✓ manage weight (gain) ✓ drugs to control glucose levels ✓</p>	<p>2 max</p> <p>List Rule If both prompt lines used and more than one suggestion is on the line mark the first one on each line. If only one line used but there is more than one suggestion listed mark first two written.</p> <p>ALLOW regulate / control / reduce , for "low" ALLOW named sugar / starch IGNORE low fat / healthy / balanced / low "carb" , diet ALLOW example of exercise e.g. walking</p> <p>ALLOW named drug e.g. metformin ALLOW ref to injecting insulin</p> <p>Examiner's Comments</p> <p>Both parts (a)(i) and (a)(ii) were well-answered by the majority of candidates. In (a)(i) many identified Type II diabetes and gave a correct explanation to gain both marks. Some explanations could have been improved by including appropriate detail e.g. by stating that cells rather than the 'body' do not respond to insulin. In (a)(ii) exercise and low sugar / carbohydrate diets were the most common correct responses but some responses referred to diet without mentioning the need to reduce carbohydrates were not credited e.g. maintain a healthy diet.</p>

			Total	4	
1 8	i	Y AND <i>idea of</i> reduces blood volume the most ✓	1 (AO3.2)	<p>e.g. 'the concentration of water in the blood would be reduced more than with the other diuretics'</p> <p>e.g. 'more urine is produced'.</p> <p>e.g. 'less water is reabsorbed into the blood'.</p> <p>ALLOW</p> <p>X</p> <p>AND</p> <p>increases the (blood) potassium ion concentration the most (as increased blood potassium linked to more sodium ion loss in urine and reduction in tension in blood vessel walls)</p>	
	ii	X AND <i>idea of</i> does not raise (blood) <u>glucose</u> (concentration) ✓	1 (AO3.2)	<p>e.g. 'has no effect on (blood) <u>glucose</u>'</p> <p>DO NOT ALLOW 'raises (blood) glucose the least'</p> <p>Examiner's Comments</p> <p>Many candidates appeared to be unfamiliar with the requirements for a good biological drawing required for question (a). Drawings often had sketchy or incomplete lines rather than clear continuous lines and the inclusion of features not visible in Fig 1.1, such as the ureter and blood vessels. Labelling errors were frequent, with tissues misidentified and label lines drawn free hand or with arrow heads.</p> <p>Many candidates could not interpret the photomicrograph in Fig 1.2, and so could not describe the function of structure A as increasing surface area for reabsorption for question (b)(ii). Most candidates understood the role of the distal convoluted tubule in water or ion reabsorption for (b)(i) and correctly identified lumen B as having the highest concentration of urea due to water being reabsorbed from an earlier part of the tubule for (b)(iii).</p>	

				<p>A surprisingly large number of candidates did not identify diuretic Y as being the most effective at reducing blood pressure due to reducing the blood volume the most. Most candidates correctly identified diuretic X as being the most suitable for use by a person with diabetes, although some candidates incorrectly stated that this diuretic raised blood glucose the least, this was not given credit.</p> <p> OCR support</p> <p>Support for drawing skills can be found in the Biological drawing skills handbook: https://www.ocr.org.uk/Images/251799-biology-drawing-skills-handbook.pdf</p> <p> AfL</p> <p>Showing students images of photomicrographs from which they need to identify structures and describe what they see may help them to answer similar questions in the future.</p>
		Total	2	
1 9		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>In summary: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</i></p> <p><i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p> <ul style="list-style-type: none"> ○ award the higher mark where the <i>Communication Statement</i> has been met. ○ award the lower mark where aspects of the <i>Communication Statement</i> have been missed. 	6 (AO1. 1 AO3.2)	<p><i>Indicative scientific points include:</i></p> <p>Insulin treatments:</p> <p><i>past</i></p> <ul style="list-style-type: none"> • from animal pancreas e.g. pig <p><i>current</i></p> <ul style="list-style-type: none"> • from e.g. GM / recombinant bacteria / humulin <p>Other current / potential treatments:</p> <ul style="list-style-type: none"> • transplant of pancreas / islets • transplant of (pancreatic) stem cells • immunotherapies / gene therapy

		<p>• The science content determines the level. • The Communication Statement determines the mark within a level.</p> <p>Level 3 (5–6 marks) An evaluation that includes treatments with insulin (past and current) AND includes another treatment (current / potential) e.g. transplant. Includes advantage and disadvantage statements for insulin and another treatment.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) An evaluation that includes treatment with insulin (past or current) AND includes another treatment (current / potential) e.g. transplant. Includes advantage and disadvantage statements for either insulin or another treatment.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Description of any treatment for Type I diabetes. Includes an advantage OR disadvantage statement.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>Level 0 (0 marks) No response or no response worthy of credit.</p>		<p><i>Advantages / disadvantages should be linked to treatment being discussed</i></p> <p>Advantages of insulin <i>animal-derived insulin</i></p> <ul style="list-style-type: none"> • tried and tested method • early treatment kept people alive <p><i>'human' insulin</i></p> <ul style="list-style-type: none"> • high purity • less risk of allergic reaction • lower production cost • overcomes religious / ethical issues of animal products • use of smart pens / pumps • detail of pump use e.g. monitored by apps <p>Disadvantages of insulin <i>animal-derived insulin</i></p> <ul style="list-style-type: none"> • needs to be purified • risk of allergic reaction • high production cost • religious / ethical issues of animal products <p><i>'human' insulin</i></p> <ul style="list-style-type: none"> • people persuaded to change from previous insulin regime e.g. animal insulin • some may not understand technology of injection routine • side effects of pumps e.g. hard lumps forming under skin <p>Advantages of other treatments <i>e.g. transplants</i></p> <ul style="list-style-type: none"> • less / no need for insulin injections • more physiological control of blood glucose compared with injection
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				<ul style="list-style-type: none"> • reduce risk of 'hypos' • improved quality of life • stem cells turned into functioning β-cells <p><i>e.g. immunotherapies</i></p> <ul style="list-style-type: none"> • 'reprogrammes' immune system • prevents / stops damage to β-cells <p>Disadvantages of other treatments: <i>e.g. transplants</i></p> <ul style="list-style-type: none"> • requirement for immunosuppression • availability of donor tissue • ethical issues associated with stem cells • risk of cancer with stem cells • not suitable for certain people e.g. those with poor kidney function • may still need low dose of insulin • initial high costs <p><i>e.g. immunotherapies</i></p> <ul style="list-style-type: none"> • still in early stages • need clinical trials
			Total	6
20			positive feedback	1
			Total	1